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*Ins. A2* **METHOD FOR DISPLAYING AUDIO SETTINGS**  
**MENU OF DISPLAY APPARATUS**  
**BACKGROUND OF THE INVENTION**

1. Field of the Invention

[001] The present invention relates to an audio menu display method, in particular to a method for displaying and selecting a multi-channel audio menu and an apparatus thereof.

2. Description of the Prior Art

[002] Among various display apparatus, there is an ATSC (advanced Television System Committee), a NTSC (National Television Standard Committee), a satellite broadcast, a SPDIF (Sony Philips Digital Interface), and an analog left/right input as an audio source inputtable to a digital television (DTV). There is a speaker output and a monitor output as an analog output from the DTV to an external device.

[003] Herein, the speaker output is connected to an outer speaker in order to output a signal amplified in the DTV, and the monitor output is connected to a power amplifier installed outside of the DTV for better sound quality.

[004] In general, a television has a speaker output, and a DVD (digital Versatile Disc) or a set-top box has only a monitor output.

[005] FIG. 1 is a block diagram illustrating audio sources inputtable to a DTV, a speaker output, and a monitor output.

[006] A DTV 5 receives signals from the inputtable sources such as a satellite broadcast source 1, a terrestrial broadcast source 2, a SPDIF (Sony Philips Digital Interface) digital signal source 3, an analog left/right source 4, and outputs an

audio signal by processing the input signals through a built-in speaker 5-1, a speaker output terminal 5-2, and a monitor output terminal 5-3. Herein, the speaker output terminal 5-2 outputs an audio signal through a speaker 6, and the monitor output terminal outputs an audio signal. An external amplifier 7 amplifies the monitor output and transfers it to the speaker 6.

[007] Below Table 1 describes the inputtable sources and the number of channels of each source.

[Table 1]

Source	Kind of audio	The number of channel
Terrestrial ATSC	AC-3	1 ~ 5.1
Terrestrial NTSC	Analog L/R	2
Satellite broadcast	AC-3	2 ~ 5.1
	MPEG	2
SPDIF digital input	AC-3	1 ~ 5.1
	MPEG	2
	PCM	2
Analog L/R input	Analog L/R	2

[008] Herein, a user can listen to audio through an internal speaker of the DTV, however, the performance of the internal speaker of the DTV is not as good as the performance of the outer (external) speaker. Although, three internal speakers can generally be installed on the left, right, and center of the DTV, a user who wants to listen to better sound or a viewer who wants to enjoy a surround or a subwoofer has to connect the outer speaker to the speaker output terminal of the DTV or has to connect the outer power amplifier to the monitor output terminal of the television.

[009] Meanwhile, when 5.1 channels are embodied on the DTV, because the sources of the DTV and channels of the sources are various, there can be lots of user selectable menus. The audio menu displayed on the analog television is no match for that. For example, when the 5.1 channels are embodied, user selectable menus can be described as below.

Example 1. Listening Mode

[010] The selectable menus in accordance with the number of the outer speakers connected to the speaker output terminals of the DTV and the number of the terminals of the outer amplifiers connected to the monitor outputs can be described as below in Table 2.

[Table 2]

Listening Mode	
Dolby digital	Left/center/left surround/right surround/subwoofer
Dolby prologic	Left/right/center/mono surround
Phantom center	Left/right/left surround/right/surround/subwoofer
3 stereo	Left/right/center
Stereo	Left/right
Mono	

Example 2. Balance Control

[011] In order to balance outputs of left/right and left surround/right surround audio signals, a balance control is performed as below.

[Table 3]

Balance Control
Left-Right Balance
Left Surround-Right Surround Balance

#### Example 3. Channel Delay

[012] For optimum listening circumstances, as depicted in Table 4, an output delay of an audio channel is adjusted so as to transmit the sound of front channels (L/R/C) and the sound of back channels (Left surround/ Right surround) to the viewer at the same time.

[Table 4]

Channel Delay
Surround time Delay
Center time Delay

#### Example 4. Volume Control

[013] It can be described as below.

[Table 5]

Volume Control	
Master Volume Control	Volume Control about all channels
Volume Control about each channel	
Test Mode	Listen a set volume of the each channel

#### Example 5. Output Construction

[014] A construction 1 and 2 described in Table 6 are for Dolby certification. According to "Licensing Information Manual" of Dolby Lab., 5.1ch DTV should have

this configuration. Herein, a name of the menu can be determined appropriately.

[Table 6]

Output Configuration	
Construction 1	Separate low-pass elements from the L/R/C/Ls/Rs channels and transmit them to the subwoofer
Construction 2	Separate low-pass elements from the C/Ls/Rs channels and transmit them to the subwoofer
Construction 3	Option item

Example 6. Additional audio service functions

[015] A digital audio signal is decoded in accordance with regulated compression standards such as an AC (audio Coding) –3 or a MPEG (Moving Picture Expert Group) etc., and is transmitted. It is possible to perform below audio services in the AC –3/MPEG.

- VI: Visually Impaired
- HI: Hearing Impaired
- ME: Music and Effects, used with Dialogue
- Dialogue: used with ME, and used for a multilingual service
- C: Commentary, comments about a program
- E: Emergency, inform an emergency
- VO: Voice Over, Overlap audio with existing broadcast audio

Example 7. Additional Menus

- Multilingual audio selection menu

- similar stereo: Make stereo with Mono source
- Front Surround: Make surround effect with a left and a right speakers
- Dynamic Range Compression On/Off: Reproduce dynamic range of AC-3 or reproduce the dynamic range of AC-3 as it is
- Prologic On/Off: When an AC-3/MPEG source encoded with Dolby prologic or 2 channel analog signal and a digital PCM signal are inputted from outside, determine automatically whether a prologic processing is performed or not

[016] As described in Examples 1 ~ 7, lots of audio menus can exist when the DTV is embodied with 5.1 channels in accordance with the conventional technology. However, the number of actual usable menus are strictly limited in accordance with the number of outer speakers connected to the speaker output terminals of the DTV or the number of outer amplifier terminals connected to the monitor output terminals, the present audio input selected among a plurality of audio inputs, and in case of the AC-3, the number of channels and the kind of services.

[017] Accordingly, these audio menus can cause confusion and inconvenience to the user, and the user can not listen to the audio properly when the wrong menu is selected.

#### SUMMARY OF THE INVENTION

[018] An object of the present invention is to provide an audio menu display method and an apparatus thereof which are capable of displaying only usable audio menus by being connected to a DTV.

[019] In order to achieve the above-mentioned and other objects, the audio

menu display method of the DTV in accordance with the present invention comprises detecting a connection state of audio output terminals, getting audio source information from audio source content received from the DTV, determining a usable audio menu for displaying on a certain screen in accordance with the connection state and audio source information, and displaying the determined usable audio menu on the screen.

[020] The audio menu display apparatus of a digital television in accordance with the present invention comprises a display for displaying video, and a CPU for displaying an audio menu on the display.

[021] These and other objects of the present application will become more readily apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[022] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein:

[023] FIG.1 is a block diagram illustrating audio sources inputtable to a DTV, a speaker output, and a monitor output.

[024] FIG.2A is a block diagram illustrating speaker output terminals in accordance with the present invention.

[025] FIG.2B is a block diagram illustrating monitor output terminals in

accordance with the present invention.

[026] FIG.3A ~ 3D illustrate examples of the monitor output terminal in accordance with the present invention.

[027] FIG.4 is a flow chart illustrating an audio menu display method in accordance with the present invention.

[028] FIG.5 is a flow chart illustrating a method for getting information of an audio source in accordance with the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[029] The present invention relates to an audio display method and an apparatus thereof which are capable of displaying only user usable audio menus among a plurality of audio menus. The user usable menus can be determined by considering the number of outer speakers connected to speaker output terminals of a TV or the number of outer amplifier channels (or terminals) connected to monitor output terminals, and the present selection of audio input among a plurality of audio inputs. For example, the usable audio menus are determined by considering the number of channels, and the kind of services in an AC-3/MPEG.

[030] First, a method for determining the actual usable audio menu will now be described.

[031] The number of the outer speakers connected to the speaker output terminals of the DTV or the number of the outer amplifier terminals connected to the monitor output terminals are determined. Herein, terminals capable of knowing a connection state of the terminals are used for the speaker output terminals and monitor output terminals. For example, when the terminal is in the connection state, high voltage is outputted. When the terminal is not in the connection state, a low voltage is outputted. Accordingly, when the output voltages are inputted to a CPU



(not shown) in a DTV, the CPU can know the present connection state of the speaker output terminal or monitor output terminal.

[032] FIG.2A is a block diagram illustrating speaker output terminals in accordance with the present invention, the output terminals having a clip form which can be used. Herein, L1 and L2 are holes for connecting each signal line.

[033] FIG.2B is a block diagram illustrating monitor output terminals in accordance with the present invention. As shown, RCA terminals can be used.

[034] FIG.3A is a front view of a male connector of a speaker output terminal in accordance with the present invention, and FIG.3B is a side view of the side connector of the speaker output terminal.

[035] FIG.3C is a side view illustrating a female connector of the speaker output terminal in accordance with the present invention, and FIG.3D is a side view illustrating a connection state of the male connector and female connector. It is designed to recognize the ON/OFF state of the speaker output terminal automatically and mechanically.

[036] FIG.4 is a flow chart illustrating an audio menu display method in accordance with the present invention. An audio menu is displayed by detecting the connection state of the present speaker output terminal or monitor output terminal by a CPU.

[037] First, the CPU (e.g., in the DTV) detects the connection state of the speaker output terminal or monitor output terminal of the DTV. For example, the number of the speakers connected to the DTV or the number of the outer amplifier terminals connected to the monitor output terminals is detected S10. Then, audio source information selected by the user and audio source content information received to the DTV is obtained S20.

[038] When the user changes the audio input source, for example, the user

changes a channel, the detecting process of step S20 is performed, as described above, because the audio source, namely, the program is changed. The detecting process of step S20 is performed whenever the audio source is changed.

[039] Herein, the content of the audio source can be detected by referencing program information or content of an audio stream in case of the ATSC or satellite broadcast. In addition, in case of digital audio input as the SPDIF (Sony Philips Digital Interface), the content of the audio source can be detected by referencing the content of the audio stream.

[040] Accordingly, the present method detects the number of the speakers connected to the TV speaker output terminals or number of the outer amplifier terminals connected to the monitor output terminals, and the present selection of audio input and content of the audio source, determines the present usable audio menus S30, and displays only the determined usable menus on the screen S40 when the user selects an audio menu.

[041] FIG.5 is a flow chart illustrating a method for getting information of an audio source in accordance with the present invention.

[042] For example, when the selected audio source is encoded with the AC-3 S21, the CPU can get the audio source information for example by checking the number of channels, whether or not the prologic encoding in present, the existence of the subwoofer channel, the existence of the multilingual service, existence of the additional audio service, etc. at S22. On the contrary, when the selected audio source is not encoded with the AC-3, the CPU can get the audio source information by checking whether or not the system is in stereo/mono state S23.

[043] The methods of FIGS. 4 and 5 can be implemented using existing hardware such as one shown in FIG. 1, if it is electronically configured to implement the present methods.

[044] The displayed audio menu will now be described in more detail in accordance with the audio source information.

[045] For example, if the audio source is a terrestrial ATSC, the kind of the audio is the AC-3 encoding, and the number of the channels is 5.1. In addition, three outer speakers are connected to a left L, a right R, and a center C of the actual speaker output terminals, and two outer amplifier terminals are connected to a left L and a right R of the monitor output terminals.

Example 1. Listening Mode

[046] Because the number of the outer speakers connected to the speaker output terminals of the DTV is three (L, R, C) and the number of the outer amplifiers connected to the monitor outputs is two (L, R), as depicted in Table 7, the user selectable menu can be described as below Table 7.

[Table 7]

Listening Mode	
3 Stereo	Left/Right/Center
Stereo	Left/Right
Mono	

[047] Example 2. Balance Control

[048] Because the surround is not connected, the balance control can be described as below Table 8.

[Table 8]

Balance Control
Left-Right Balance

### Example 3. Channel Delay

[049] In order to allow the viewer to listen to the sound in the optimum listening circumstances, the output delay of an audio signal is adjusted so as to transmit the sound of the front channels L/R/C and the sound of the back channels (Left Surround/Right Surround) to the viewer at the same time. Herein, the Surround is not connected, and accordingly it is not displayed.

### Example 4. Volume Control

[050] It is displayed about the L, R, C channels, which can be described as below Table 9.

[Table 9]

Volume Control	
Master Volume Control	Volume Control about the L, R, C channels
Volume Control about the L, R, C channels	
Test Mode	Listen a set volume of the each L, R, C channel

### Example 5. Output construction

[051] Because there is no subwoofer, it is not displayed.

### Example 6. Additional audio service functions

[052] Below additional audio services are possible in the AC-3/MPEG.

- VI: Visually Impaired
- HI: Hearing Impaired
- ME: Music and Effects, used with Dialogue
- Dialogue: used with ME, and used for a multilingual service
- C : Commentary, comments about a program
- E: Emergency, inform an emergency
- VO: Voice Over, Overlap audio with existing broadcast audio

Example 7. Additional menus

- Multilingual select menu
- similar stereo : Make stereo with Mono source
- Front Surround : Make surround effect with a left and a right speakers
- Dynamic Range Compression On/Off : Reproduce dynamic range of AC-3 after reducing it or reproduce the dynamic range of AC-3 as it is

[053] Accordingly, the displayed audio menus are strictly limited in accordance with the number of outer speakers connected to the speaker output terminal of the TV or the number of the outer amplifier terminals connected to the monitor output terminal, the present audio input selected among a plurality of audio inputs, and in the AC-3, the number of channels and kind of services.

[054] The present invention can be adapted to audio menus of a set-top box, an A/V amplifier, an A/V receiver as well as the DTV.

[055] The above-described audio menu display method and an apparatus thereof in accordance with present invention are capable of preventing the user from

setting audio menus wrongfully, and selecting the audio menu conveniently by displaying only the present usable audio menus to the user. Particularly, when the 5.1 channels are embodied, because the present invention arranges many and complicated audio menus and displays only the present usable menus to the user, it is possible to provide convenience to the user in the audio menu selection process.

[056] The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.